Nutritional Value, Shelf Life and Sensory Evaluation of Arrowroot Bread Enriched with *Okara* (Soy Residue)

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ABSTRACT

Arrowroot bread is a kind of modified food as alternative breakfast for students. In order to improve the nutritional value of arrowroot bread, it was added with soy residue or *okara* which is known contain high protein. This study aims to determine the effect of the addition of *okara* in arrowroot bread on nutritional value, shelf life and sensory evaluation. This is an experimental study using a completely randomized design (CRD). The treatment was the variation of *okara* concentration (F1, F2 and F3). Three formulas were then investigated for their nutritional values including carbohydrate, protein and fat. The bread shelf life was determined using Total Plate Count (TPC). The sensory evaluation was also carried out to determine the preferred formula. The variation of *okara* concentration affect the nutritional value, shelf life and sensory evaluation of arrowroot bread. F3 which is composed by 60% of *okara* contain more carbohydrate, protein and fat compared to other formulas. The maximum shelf life of these products was three days in room temperature. Whereas F1 showed higher acceptability on sensory evaluation. The addition of *okara* in arrowroot bread gave a significant contribution to nutritional value so it might be developed as a nutritious bread preferred by consumers.

Key words: arrowroot bread, okara, soy residue, nutritional value, shelf life, sensory evaluation

INTRODUCTION

The habit of breakfast in school age children still tends to be low. Skipping breakfast in the morning can cause the condition of hypoglycemia resulting weakness, drowsiness and difficulty to receive lessons in school (Irianto, 2007). One alternative encouraging children to have breakfast in the morning is by modifying breakfast with the food preferred by children, nutritious and fast prepared such as cereal, sandwich, sweet bun and bread. Bread is a food that quite popular in Indonesia for breakfast and snack.

Bread is made from wheat flour which able to absorb the amount of water to achieve the right consistency of dough and to produce bread with a soft texture and a large volume (Mudjayanto and Yulianti, 2007). Arrowroot (*Maranta arundinaceae L*) is one tuber from Indonesia which has potential as substitute of wheat flour in bread making preparation (Wijayanti 2007).

Bread can be enriched with soy residue, called *okara*, to enhance the nutritional value. *Okara* still has a relatively high protein content because not all parts of protein can be extracted during manufacturing process of tofu or soy milk, especially when using a traditional grinding process (Santoso *et al.*, 2006).

The evaluation of consumer acceptance for a new product is usually performed by sensory evaluation. This evaluation usually aims to develop new products with acceptable quality, to improve the product quality as well as to measure the effect of new material use (Hanum, 1998). Based on this background, we interested to investigate the effect of the addition of okara (soy residue) in making arrowroot bread on the nutritional value, shelf life and sensory evaluation.

MATERIALS AND METHODS

This experimental study was carried out in the laboratory of Health Polytechnic of Bengkulu during April-December 2014. The study design was completely randomized design (CRD) with 1 factor which is variation of tofu concentration. We made three formulas of arrowroot bread, namely F1, F2 and F3 with composition of ingredients as shown in Table 1.

Tabel 1. Formulation of Arrowroot Bread

Composition	The amount of material (gram)		
	F1	F2	F3
Wheat flour	200	200	200
Okara flour	20	30	40
Arrowroot flour	30	30	30
Sugar	30	30	30
Low fat milk	25	25	25
Shortening	30	30	30
Salt	7.5	7.5	7.5
Yeast (fermipan)	5	5	5
Yolk	30	30	30
Water	165	165	165

Bread-making process began by making a homogeneous dough. The printed dough was then baked at 220^{o}C for 20-25 minutes and cooled for 20 minutes. The sample of bread was then analyzed using proximate test to determine the content of nutrients (carbohydrate, fat, protein), whereas Total Plate Count (TPC) was used to determine the shelf life and finally sensory evaluation using hedonic scale test was carried out to determine the panel acceptances for arrowroot bread enriched with *okara*.

RESULTS AND DISCUSSION

Nutritional Value and Proximate Analysis

The proximate test results are presented in Table 2. The arrowroot bread of formula F3 has higher nutritional content compared to other formulas. The utilization of *okara* enhanced the macronutrient contents including carbohydrate, protein and fat of arrowroot bread. The addition of *okara* also increased the iron content. F3 which contains higher concentration of okara showed has higher ash content and moisture content. Bread quality standard according to SNI 1995 mentioned a proper moisture and ash content are maximum 40% and 3% respectively.

Table 2. Nutritional value and proximate analysis of arrowroot bread

Proximate Analysis	Bread Formula		
	F1	F2	F3
Energy (kcal)	243.32	251.6	259.8
Protein (gr)	8.14	8.67	9.2
Fat (gr)	2.46	2.82	3.2
Carbohydrate (gr)	46.37	47.18	48.02
Iron (mg)	1.04	1.12	1.2
Ash (%)	1.73	2.58	2.87
Water (%)	16.55	18.86	2463

Shelf Life

The resulting arrowroot bread has maximum storage for 3 days at room temperature which shown by the number of microbial growth (Table 3). Three formulas of arrowroot bread (F1, F2, F3) were stored at room temperature (27^{o}C) and then observed and performed the count of microbes. On the third day of storage, the arrowroot bread could no longer to consumed because it smells rancid, color change, and moldy. Total Plate Count (TPC) showed the number of microbes in F1, F2 and F3; 5.29 x 104 CFU / g, 5.72 x 104 CFU / g and 7.5 x 104 CFU / gram respectively. These number are already pass the maximum limit of the quality standard of bread.

Table 3. The number of microbes according to storage time

	Average number of microbes (CFU/g)		
Day	F1	F2	F3
1	0	0	0
2	4.63×10^3	1.66×10^2	3.96×10^3
3	5.29×10^3	5.72×10^4	7.5×10^4

Sensory Evaluation

Sensory evaluation was carried out on 80 panels of elementary students and 30 trained panels to know the preference of panels towards arrowroot bread enriched with *okara*. Kruskal Wallis test result showed that the addition of *okara* flour affect the organoleptic acceptability of color, flavor, aroma and texture of bread ($p = 0.000$). Arrowroot bread F1 was the most preferred formula by panels. Wijayanti (2007) reported that the addition of okara flour and arrowroot flour reduce the organoleptic acceptability especially taste property because the use of arrowroot flour produces less savory in bread.

According to Nasution (2000) in Winata (2001), taste attribute is the most important factor in the final decision of consumers to accept or reject a food. Although the color, flavor, and texture were good, if the taste was bad then the consumer will refuse the food. The taste attribute was assessed from the response to chemical stimuli by sensory taster (tongue), which finally unified interaction between the properties of aroma, flavor and texture are an overall sense assessed.

CONCLUSIONS

Arrowroot bread with formula F3 contain higher energy, protein, fat, carbohydrate, iron, ash content and high moisture content compared to other formulas. The produced arrowroot bread can be stored for 3 days. Bread with formula F1 was preferred by panels according to sensory evaluation. Further research, we need to investigate the methods due to making the arrowroot bread has longer shelf life.

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